- Due to the maximum receptivity, the input energy is optimally transferred to small scales from large scales so that the achieved mixing enhancement and efficiency is clearly much higher than others used.
- The mixing chamber is fully used.
- No died and back flow region exists.
- Since no blade is used, the problem with cell breaking can be solved.
- The installation of the mixer and its construction is simpler.
- The process is in continuous operations.
- It is easier to control the mixing and temperature.
- When used for reactor, the scaleup would be easier, due to the fact that the scale of scalar is more homogeneous distributed because of the possibility of the control of the small structures and therefore the reactor modeling can be more accurate.

Claims

What is claimed is the process of mixing of fluids, which is based on the receptivity mechanism, i.e., the periodical excitation of the characteristic instability behavior of the shear layer (mixing layer or wake) downstream of the splitter plate between the two initial streams for a given special geometry of the mixing chamber. For a given special geometry of the mixing chamber and the three dimensionality of the flow there exists a selective receptivity of the unstable shear layer between the two streams by a frequency, which depends on the geometry and size of the mixing chamber. The excitation under this suitable frequency leads to a continuos, very homogeneous mixing over a short downstream distance from the trailing edge.

The process is characterized by

(1) A whole mixing chamber, consisted of one or more tubes, in each of which the fluids, which are to be mixed, come in separately and will first meet each other there downstream of the trailing edge of the splitter plate. The flow becomes three dimensional due to the secondary vortices, two kinds of which are produced in the corner between the splitter plate and the tube wall and other two of which are produced in the center line of the tube parallel to the streamwise direction. As a result, the three dimensional structure are constructed due to the influence of the wall, and the three dimensionality, in turn, in essential for the function of the mixing process.

(2) The necessary excitation for the mixing process, which is based on a new receptivity mechanism discovered by the authors recently and also characterized by the three dimensional structures. This requires the fluid velocity of one of the two initial streams or both streams to be overlapped by a periodic component, i.e. $U(t) = U_0 + u(t)$, and $u(t) = u(t+T)$, where U and U_0 is the transient and average local velocity respectively, t and T is time and time period respectively. Not only the frequency, but also the periodic fluctuation amplitude of the excitation should be adjustable to match the geometry of a given mixing chamber for the optimization of the mixing process. Several methods can be used to produce

the periodic velocity component, such as a forced flap in trailing edge, forced membrane, piston-pump or a periodic adjustable valve upstream of the trailing edge.